

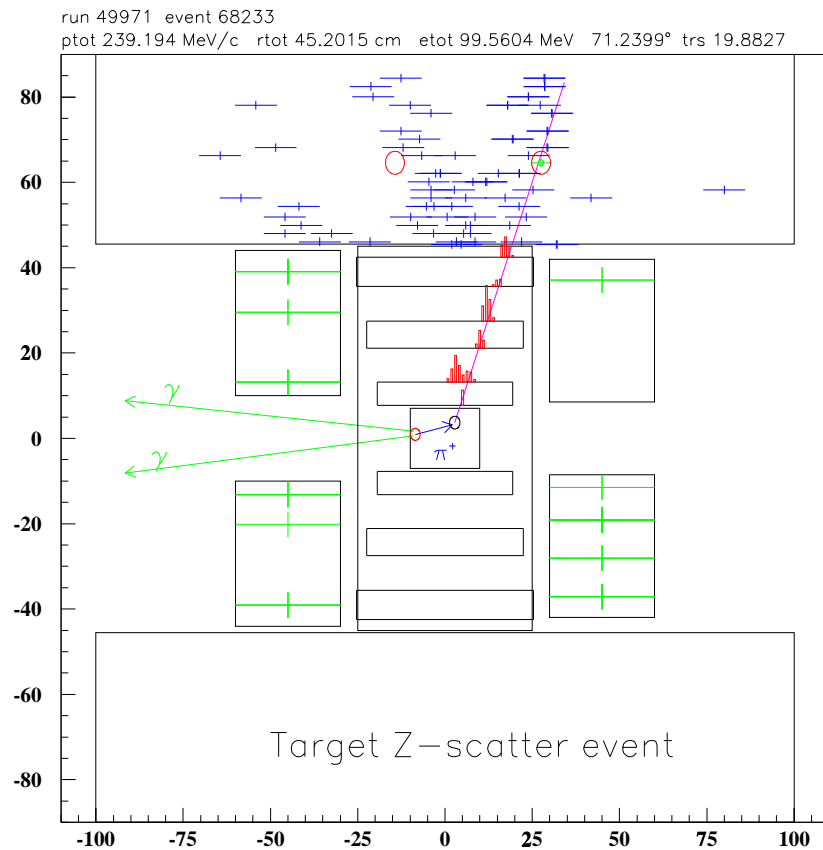
pnn2 studies on $K^+ \rightarrow \pi^+ \pi^0$ Target Scatters

e949 September 2004 meeting

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Motivation for $K^+ \rightarrow \pi^+ \pi^0$ -scatter studies

- As seen in e787, Target $K_{\pi 2}$ -scatters is the dominant background ($\sim 70\%$).



TGrecon Algorithm

- Reasons to create a new *SWATHccd* algorithm:
 - Allow KINKs in the target π track.
- Differences between *TGrecon* and *SWATHccd*
 - *TGrecon* uses a *swath* as a criteria for picking the best K/ π match. *SWATHccd* is highly dependent on the UTC track *swath*.
 - Late Ks ($> 8\text{ns}$) have the same 'weight' during K/ π matching.
 - *TGrecon* allows for quicker improvements due to modular design.
- Similarities between *TGrecon* and *SWATHccd*
 - Good agreement in TG quantities.
- Improvements
 - *TGrecon*
 - Opposite-side Pion problem.
 - Apply Swath-Likelihood function to tracks with kinks.
 - further improves TGrecon emulation of Swath.

Kink Finding Algorithm

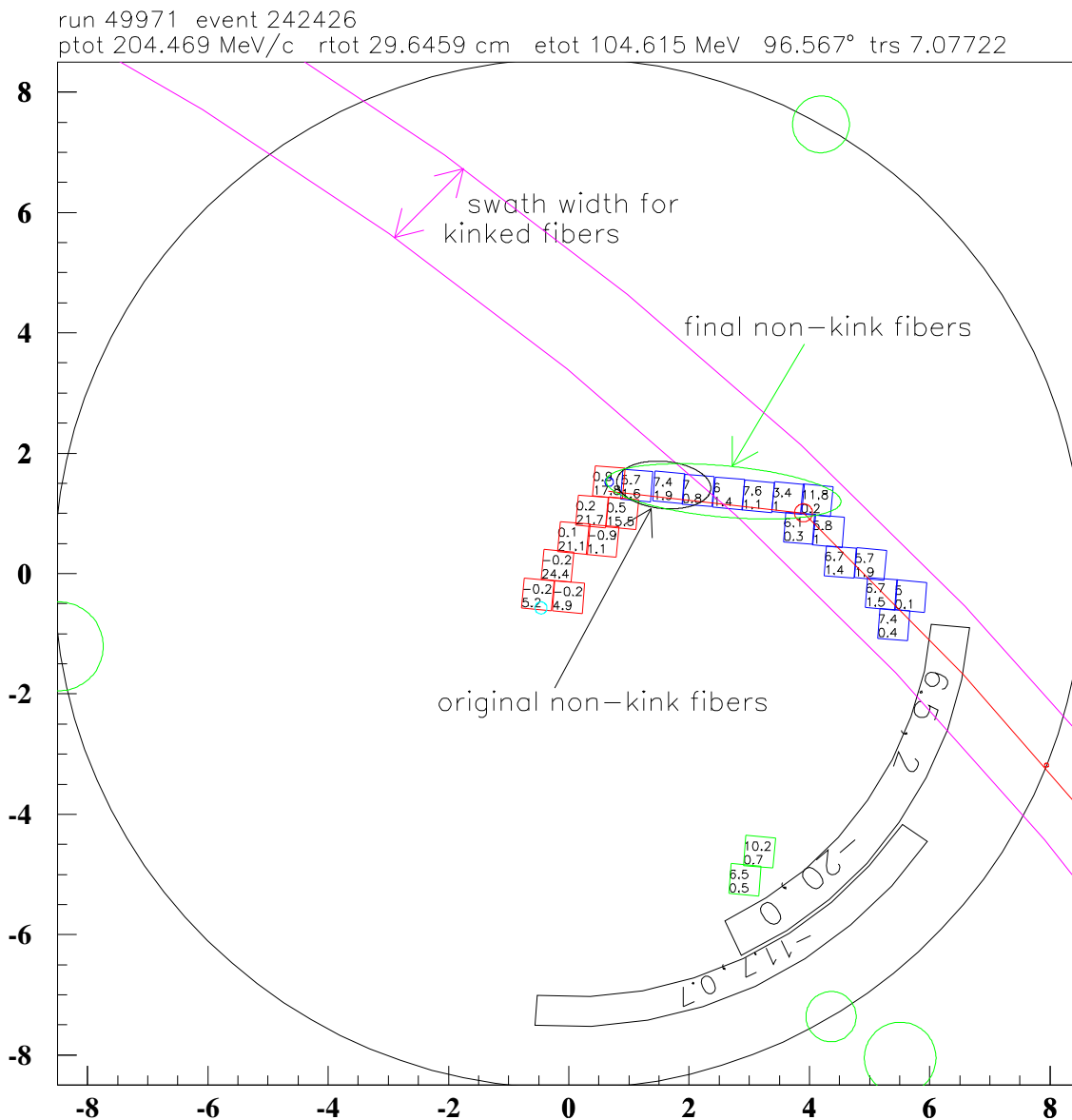
- How *KinkFinder* works.

- Classifies π fibers as kinked or non-kinked.
- Does Least-squares fit on non-kinked fibers.
- Requirements:
 - Must have ≥ 2 fibers off swath (swath = 0.8cm)
 - Pass a minimum angle threshold ($\sim 7^\circ$).
- Fit a track to the non-kinked fibers.

- Improvements to *KinkFinder*.

- Improved routine to order the fibers.
- Determines the point of the scatter.

2004/02/04 13.55



KinkFinder Efficiency

- Use a $K_{\mu 2}$ event to determine *false* kink rate.
 - We don't expect the μ from $K_{\mu 2}$ to scatter in the target.
So any kinks flagged by *KinkFinder* as a scatter will mostly likely be wrong.
 - Setup Cuts: **PS Cuts (mod for Kinks)**
Flagged as kink.
Reconstructed by *SWATHccd* / *TGrecon* .
 $(T_{\pi} - T_K) > 6$
 - Tighter Cuts:
 $220 < p_{tot} < 260$
 $e_{tot} > 140$

Improvements in Red

Real Kinks founded by visual examination.

small set	Sample	Flagged as Kink	Real Kinks	False Kinks
$K_{\mu 21}$	7625	69 (44)	-	0.9% (0.6%)
TG reconstructed	7120	62	-	0.9%
Setup cuts	4288 (3245)	21 (4)	3 (2)	0.4% (0.06%)
w/Tight cuts	2858 (584)	7 (1)	2 (1)	0.2% (0.0%)

Kinks in pnn2 data

- e787 $K_{\pi 2}$ -scatter background

- Used 17 classes of events inside the $K_{\pi 2}$ -BOX or PNN2-BOX regions with various cuts applied. Generally, CCDPUL or 567 was inverted.

CCDPUL - find extra energy in kaon fibers at π time.

CHI567 - is the probability from the target track fitting program.

Description	CLASS 7	CLASS 9	ONEBEAM
NO CCD FIT	1	-	-
K Decay in IC	1	4	-
T_{π} inconsistent	1*	1*	-
Kink in π^+ track	3	7	-
π^+ scatter under K	-	6	-
Gap in π^+ fibers	-	2	-
$T_{\pi} < T_K$	-	-	1
Prompt K decay	-	-	4
Totals	6	21	5

* = same event

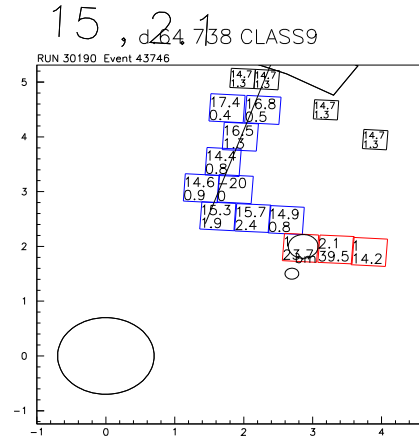


Figure 1: Run 30190, event 43746 shows a clear kink in the pion fibers. From the response of the CCDs shown in figure 2, it is clear that the pion track traverses the three kaon fibers before scattering.

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- e949 1/3 Pass1 output
- Using *SWATHccd* as the main reconstuctor
TGrecon tries when *SWATHccd* fails.

	Sample	Flagged as Kink	Kinks
pass1 output	1219035 (337524)	7364 (6221)	0.6% (1.8%)
TG reconstructed	861137	6675	0.8%
Setup cuts	377735 (28166)	1787 (253)	0.5% (0.9%)

78M events out at pass1 $\rightarrow \sim 400k$ **TG** scatters.

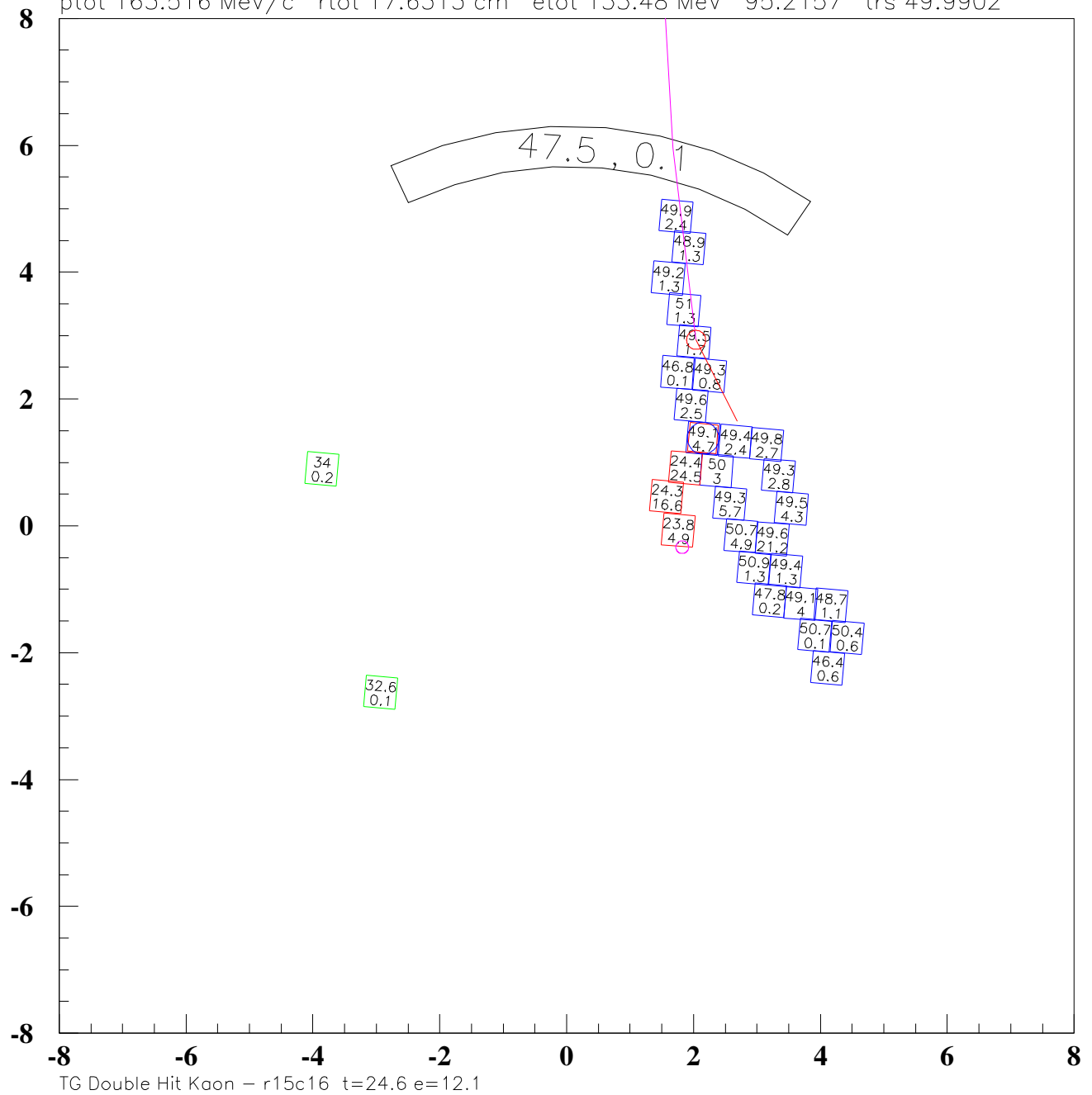
Kinks that passed PV

Before...

2004/06/15 11.18

run 50042 event 115290

ptot 163.516 MeV/c rtot 17.6313 cm etot 133.48 MeV 95.2157° trs 49.9902

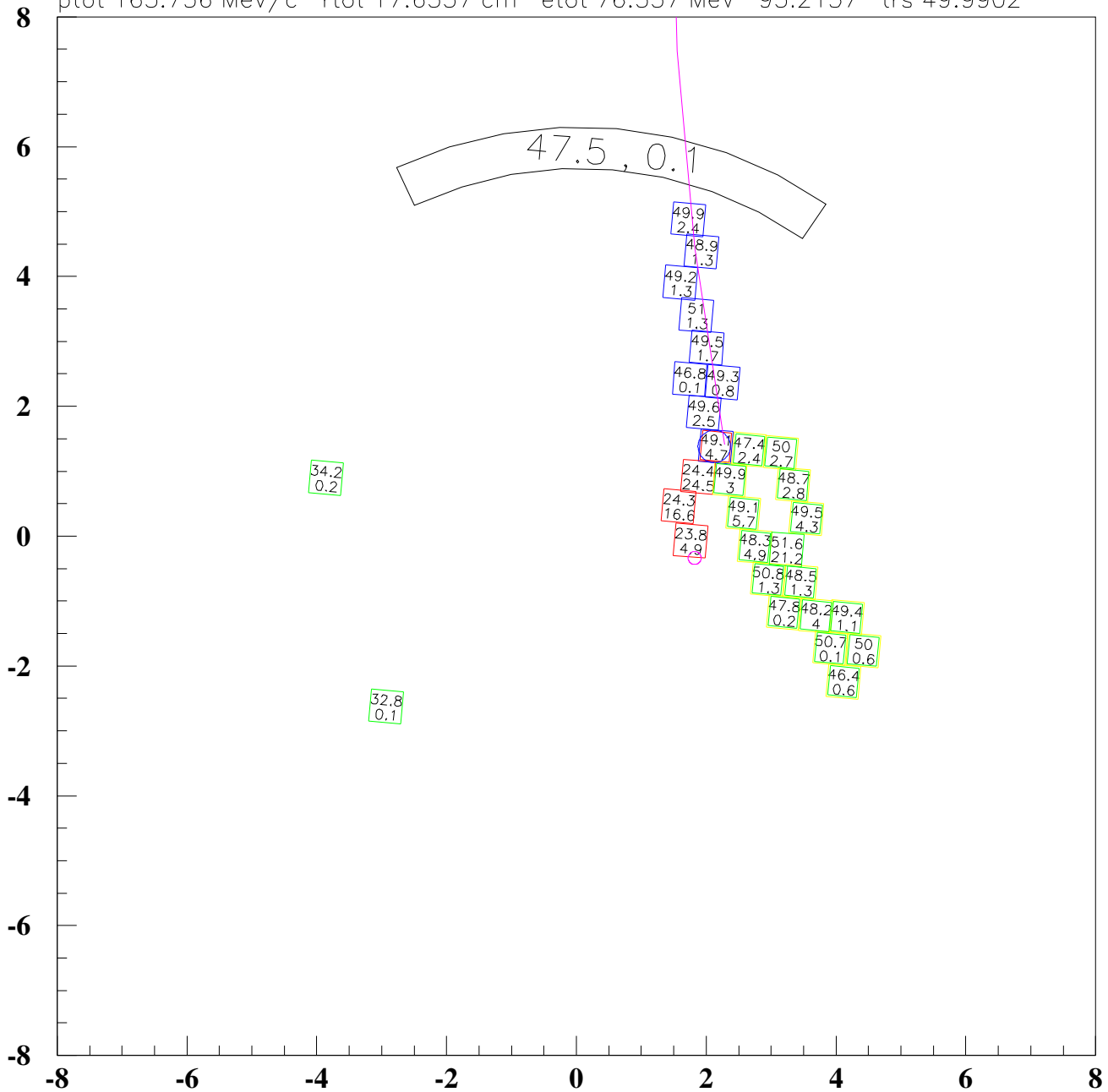


After improvements

2004/09/14 05.03

run 50042 event 115290

ptot 163.736 MeV/c rtot 17.6557 cm etot 76.337 MeV 95.2157° trs 49.9902



TG Double Hit Kaon - r15c16 t=24.6 e=12.1

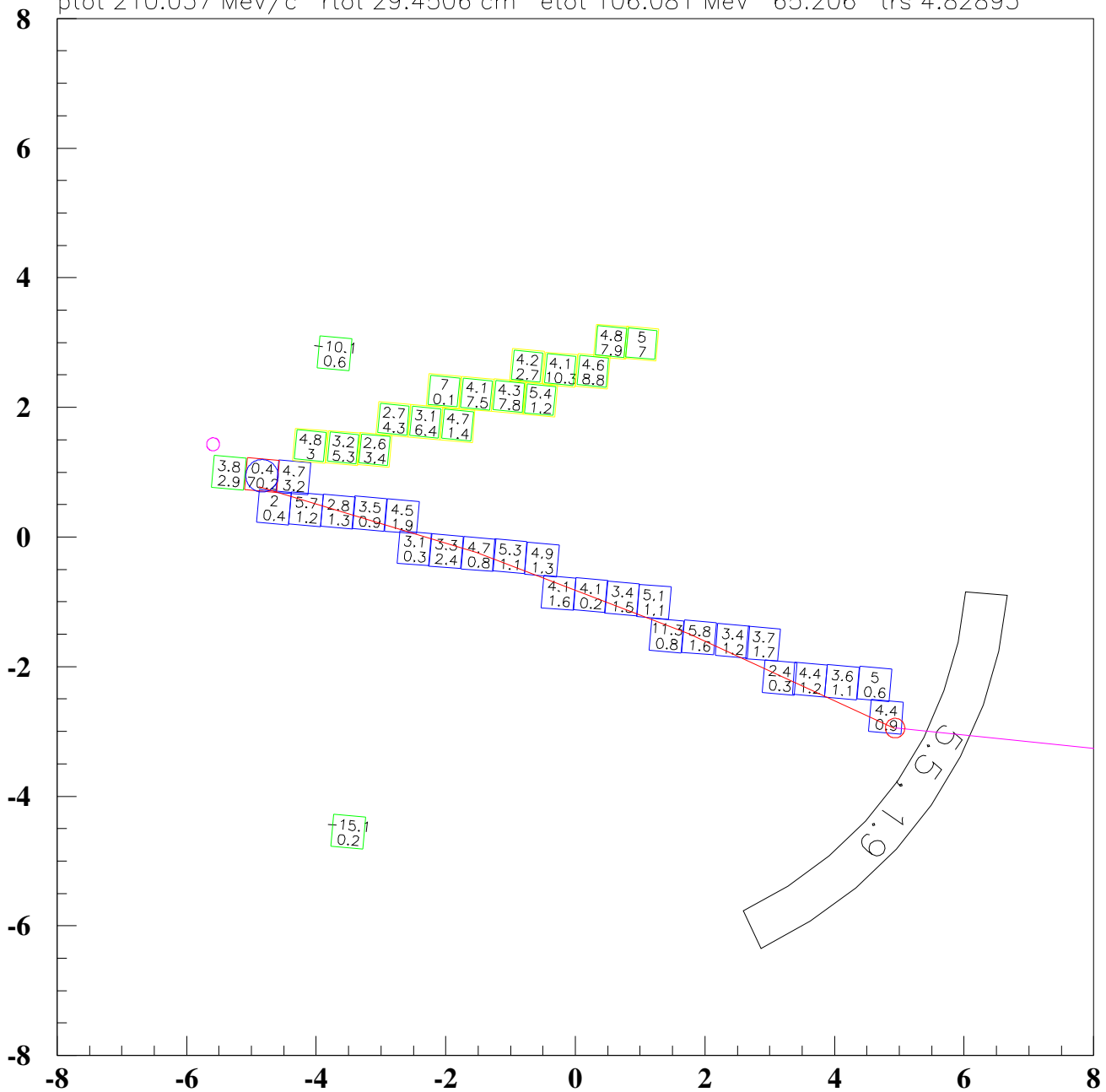
After improvements

2004/09/14 04.46

run 49509 event 7584

KINK 81.2851° rzk 10.6549cm rznk 10.6549cm slope 0.32967 sm 0.0366287 r² 0.950147

ptot 210.037 MeV/c rtot 29.4506 cm etot 106.081 MeV 65.206° trs 4.82893

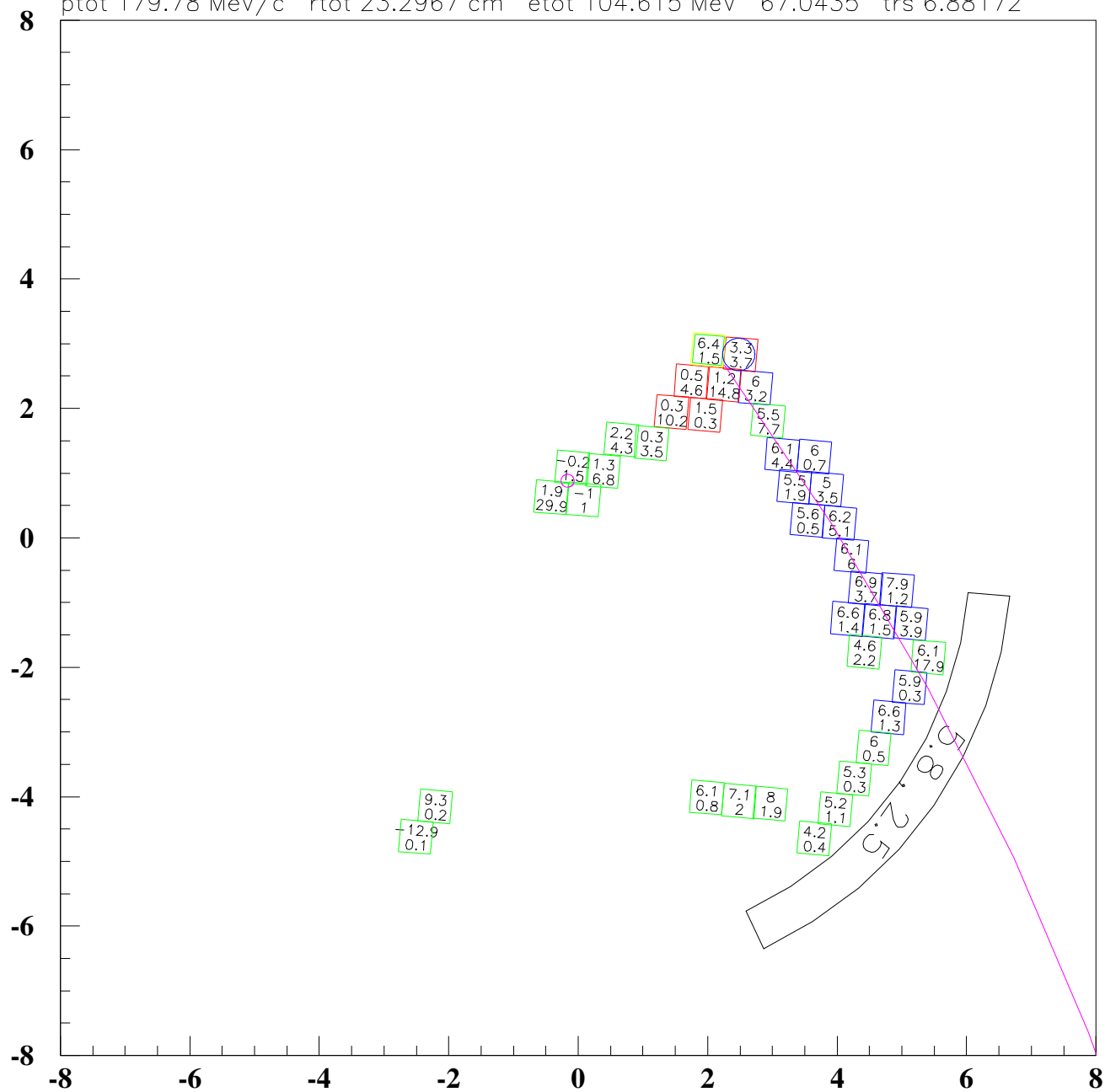


After improvements

2004/09/14 04.50

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run 50042  event 11496
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ptot 179.78 MeV/c rtot 23.2967 cm etot 104.615 MeV 67.0435° trs 6.88172



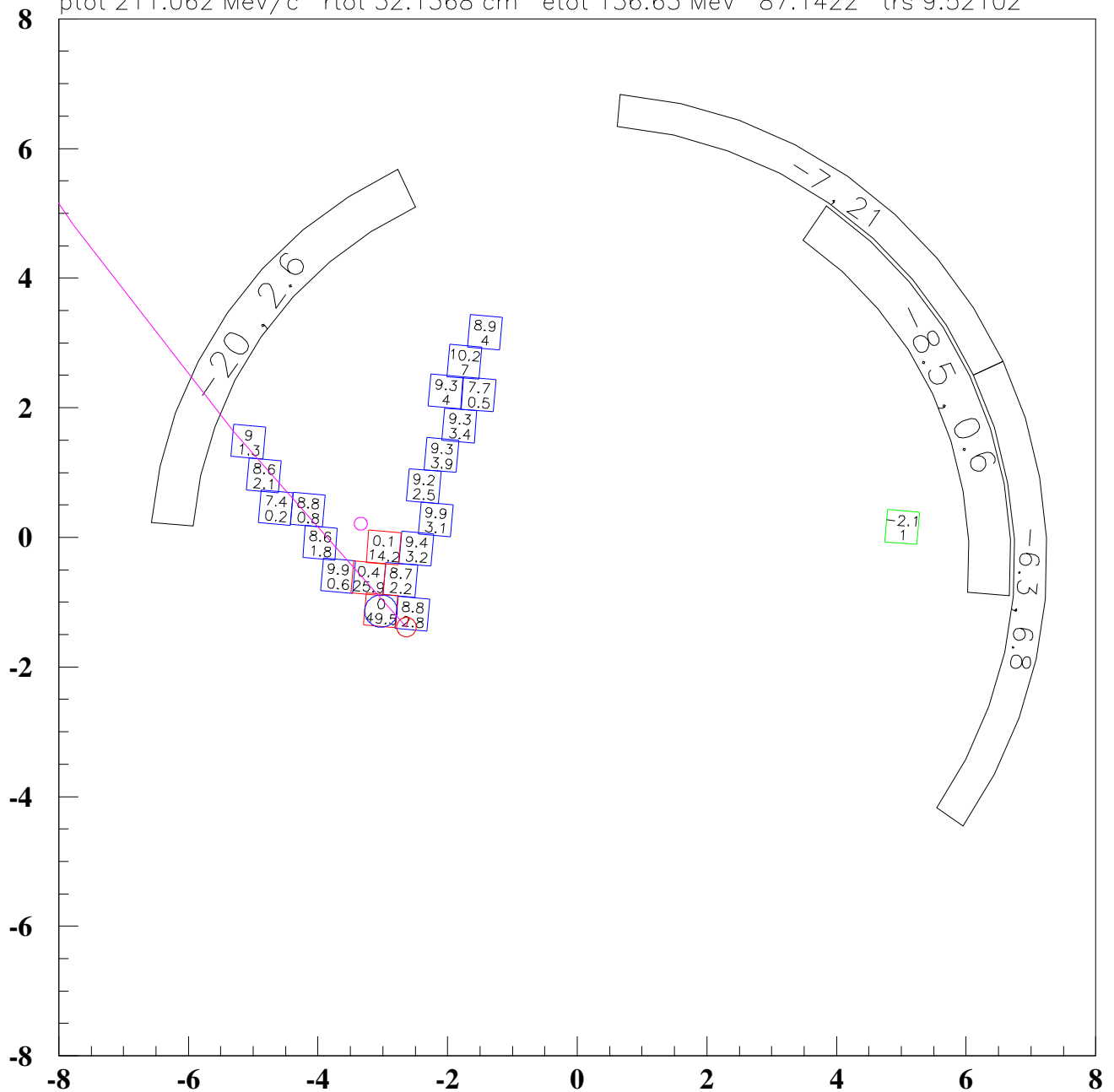
Kinks that passed PV

Before...

2004/06/15 11.25

run 50187 event 39663

ptot 211.062 MeV/c rtot 32.1368 cm etot 136.63 MeV 87.1422° trs 9.52102

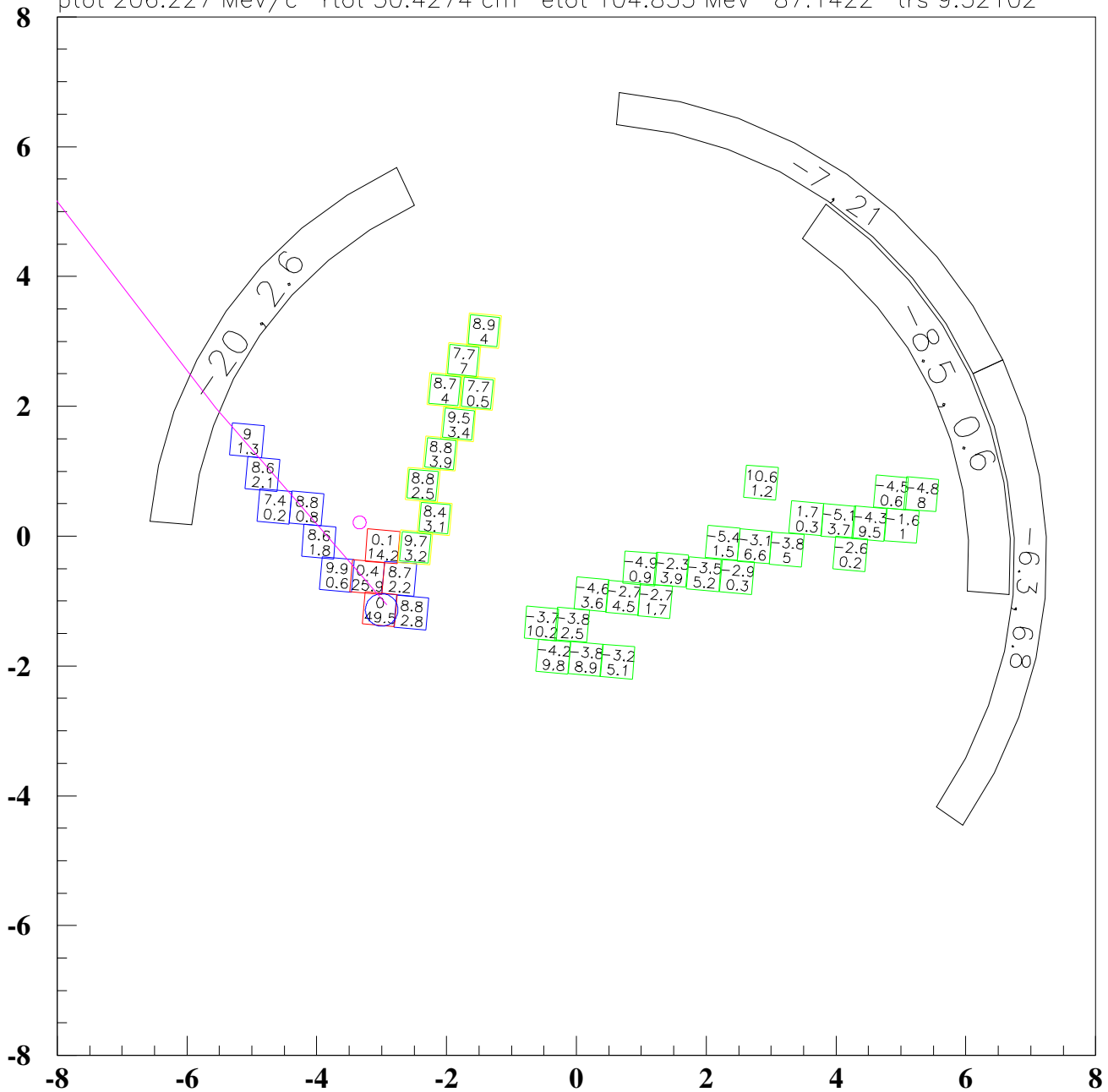


After improvements

2004/09/14 05.10

run 50187 event 39663

ptot 206.227 MeV/c rtot 30.4274 cm etot 104.835 MeV 87.1422° trs 9.52102



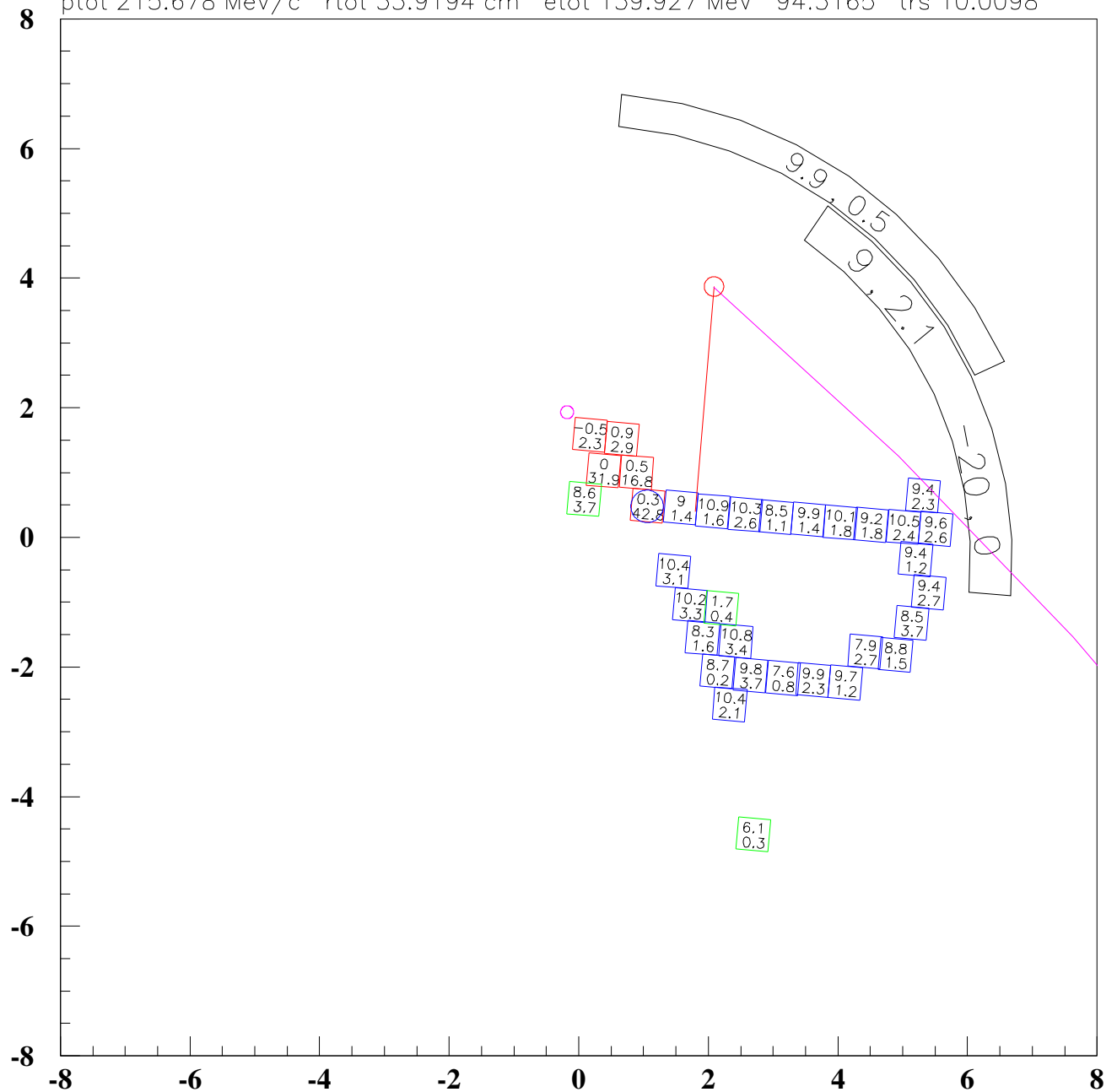
Kinks that passed PV

Before...

2004/06/15 11.42

run 49157 event 8640

ptot 215.678 MeV/c rtot 33.9194 cm etot 139.927 MeV 94.3165° trs 10.0098



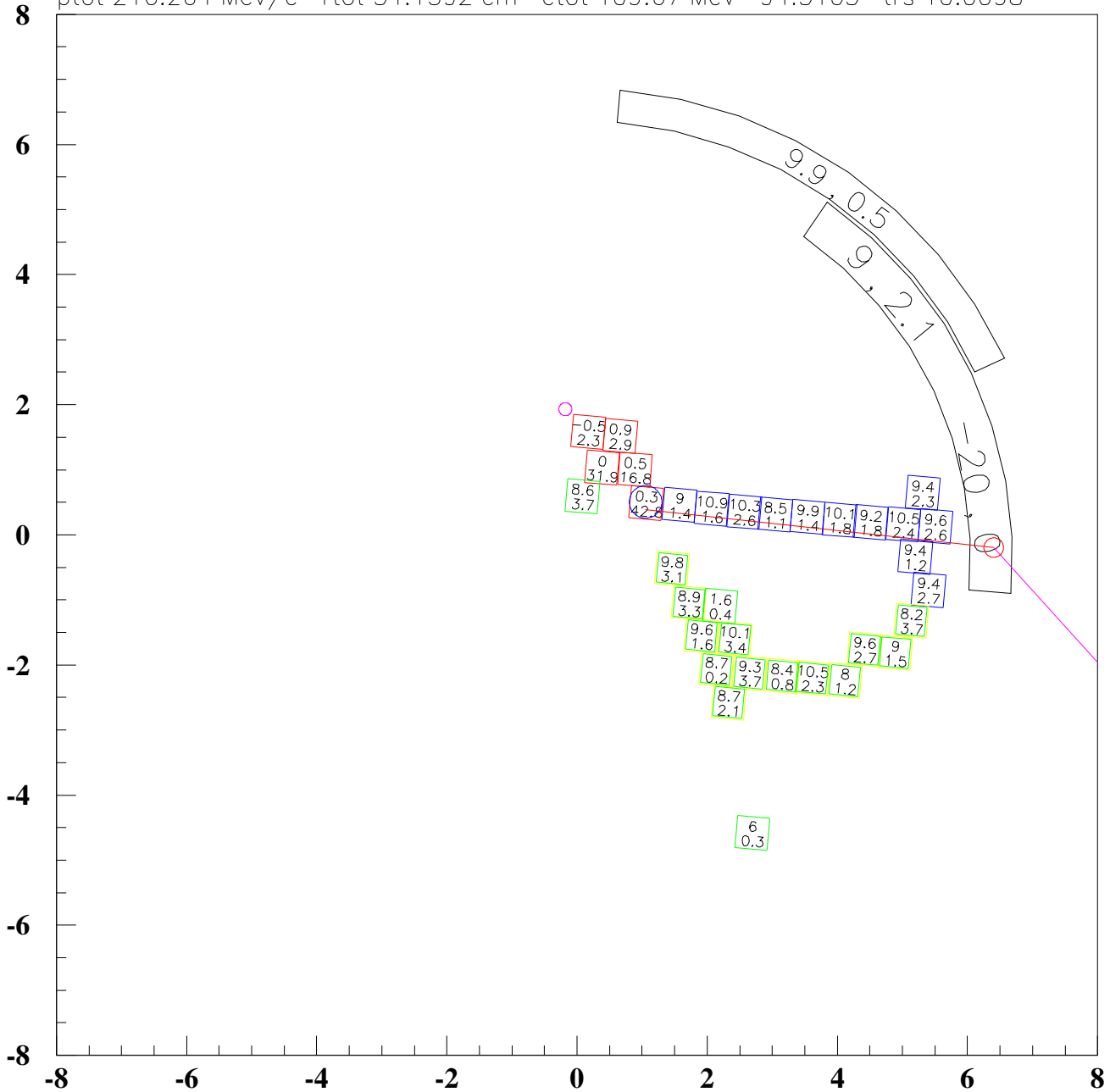
After improvements

2004/09/14 05.16

run 49157 event 8640

KINK 140.291° rzk 8.45552cm rznk 8.45552cm slope 0.647129 sm 0.0610504 r² 0.962854

ptot 216.264 MeV/c rtot 34.1392 cm etot 109.67 MeV 94.3165° trs 10.0098



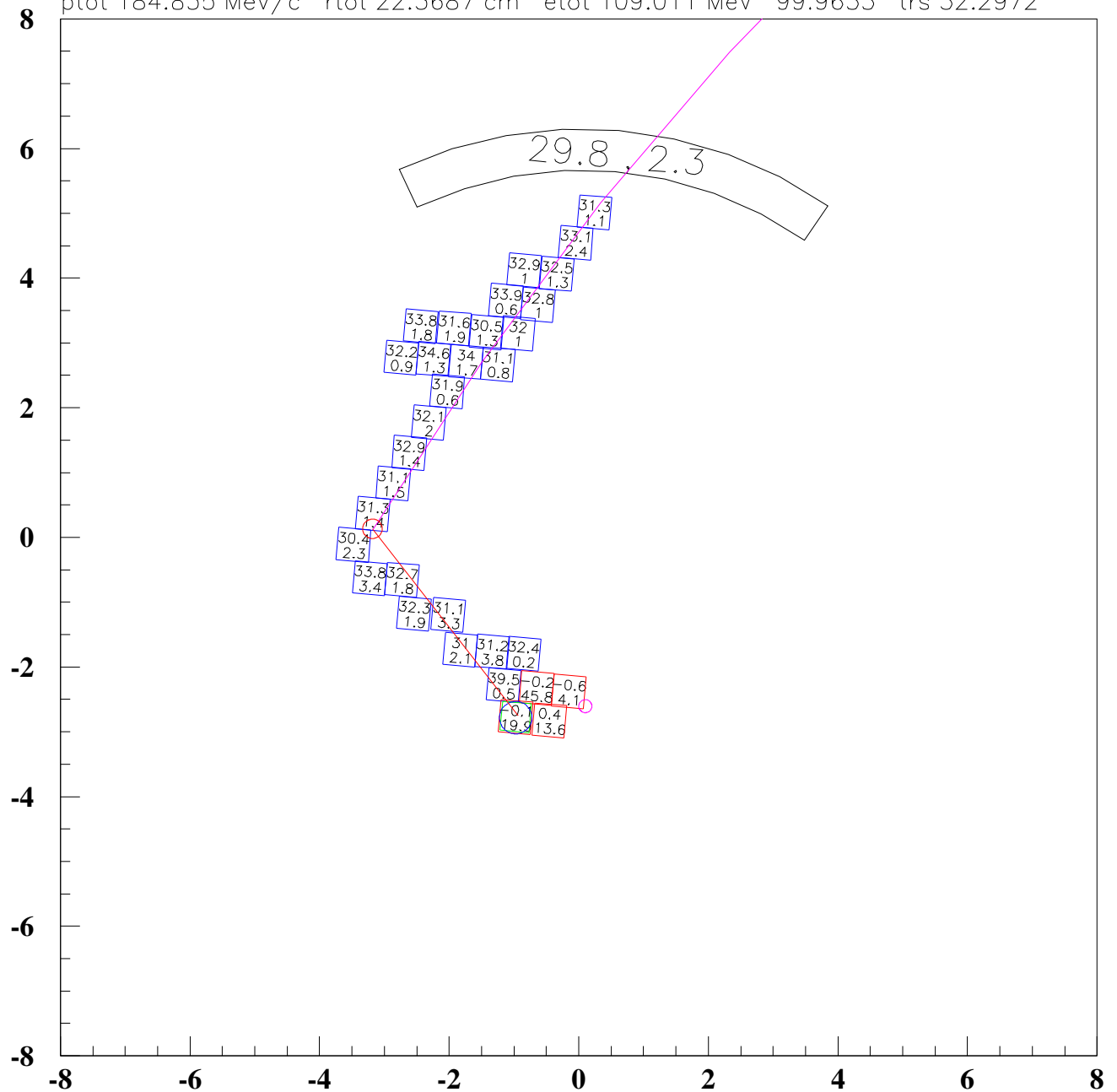
Kinks that passed PV

Before...

2004/06/15 11.27

run 50192 event 22965

ptot 184.835 MeV/c rtot 22.3687 cm etot 109.011 MeV 99.9633° trs 32.2972



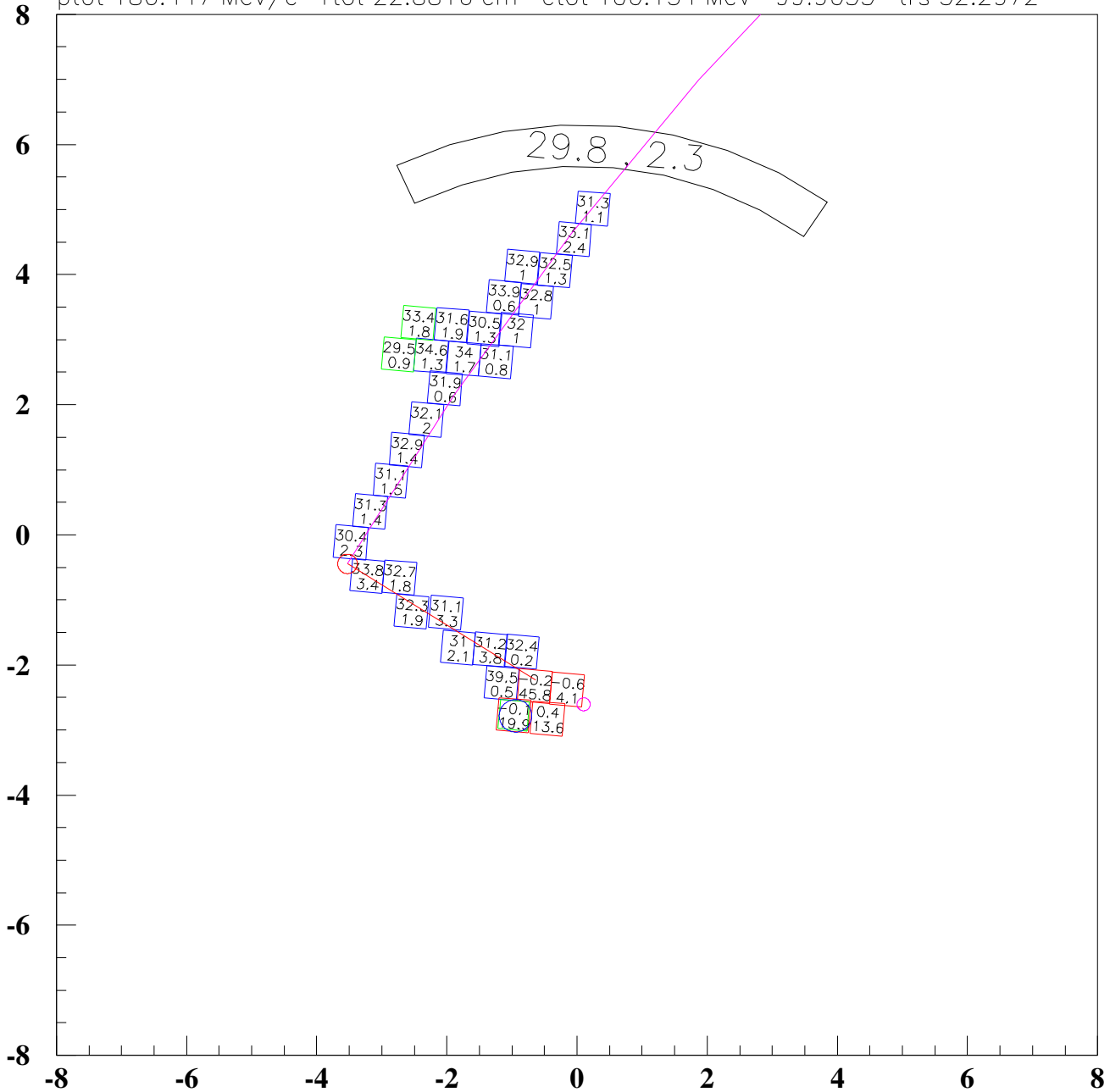
After improvements

2004/09/14 05.11

run 50192 event 22965

KINK 90.1678° rzk 3.47019cm rznc 3.47019cm slope 2.84493 sm 0.28083 r^2 0.660802

ptot 186.447 MeV/c rtot 22.8816 cm etot 106.154 MeV 99.9633° trs 32.2972



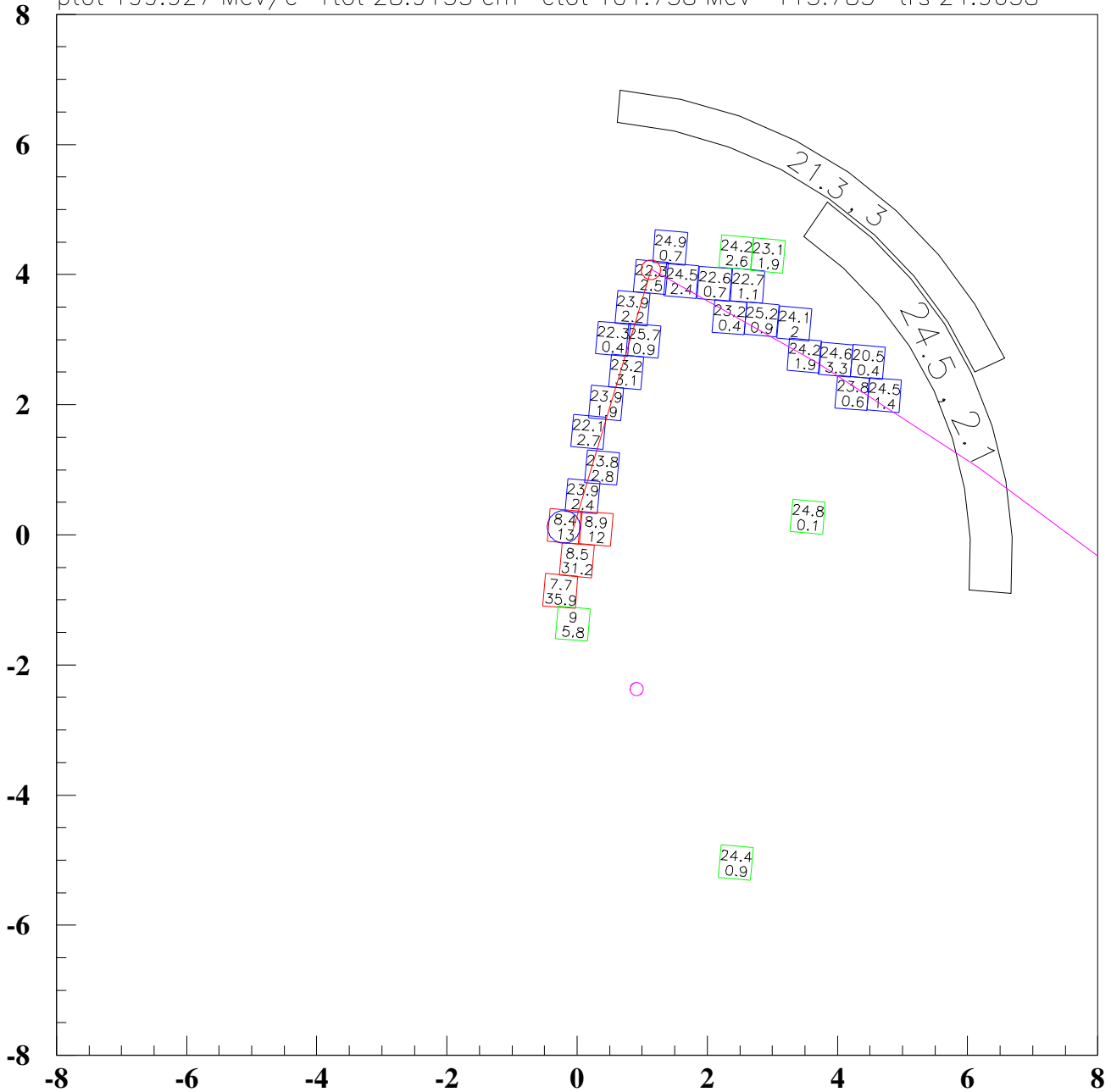
After improvements

2004/09/14 05.05

run 50138 event 170865

KINK 140.467° rzk 6.5738cm rznk 6.5738cm slope 3.21124 sm 0.427349 r^2 0.294233

ptot 199.927 MeV/c rtot 28.9133 cm etot 101.758 MeV 115.785° trs 24.9658



After improvements

2004/09/14 05.07

run 50148 event 3687

KINK 36.8138° rzk 8.08895cm rznk 8.08895cm slope 0.525032 sm 0.0610504 r² 0.713587

ptot 212.601 MeV/c rtot 33.1624 cm etot 114.286 MeV 96.2289° trs 18.7097

